



THE UNIVERSITY *of* EDINBURGH

Edinburgh Research Explorer

Tackling industry's carbon emissions: drivers and barriers to CO capture in Scotland

Citation for published version:

Brownsort, P & Parmiter, P 2013, Tackling industry's carbon emissions: drivers and barriers to CO capture in Scotland. SCCS Workshops for Industrial Emitters, SCCS.

Link:

[Link to publication record in Edinburgh Research Explorer](#)

General rights

Copyright for the publications made accessible via the Edinburgh Research Explorer is retained by the author(s) and / or other copyright owners and it is a condition of accessing these publications that users recognise and abide by the legal requirements associated with these rights.

Take down policy

The University of Edinburgh has made every reasonable effort to ensure that Edinburgh Research Explorer content complies with UK legislation. If you believe that the public display of this file breaches copyright please contact openaccess@ed.ac.uk providing details, and we will remove access to the work immediately and investigate your claim.





SCCS Workshops for Industrial Emitters

Tackling industry's carbon emissions: drivers and barriers to CO₂ capture in Scotland



Outputs Report

Background and Objectives

Scotland's manufacturing industries are key to its prosperity. However, inward investment in processes such as oil refining, chemical manufacture and cement manufacture will be increasingly affected by the implementation of environmental regulations, such as the European Union's Industrial Emissions Directive. In addition, anticipated rises in carbon prices within the EU Emissions Trading Scheme (ETS) will only add to the challenges faced by industry.

In autumn 2013, Scottish Carbon Capture & Storage (SCCS) held two workshops, which brought together key players from Scottish industry, government and academia, to explore the drivers and barriers to implementing carbon capture for industrial sources across Scotland. The workshops were funded by Scottish Enterprise.

Although some analysis of industrial emitters and clusters of these businesses has already been undertaken in Scotland¹, this has largely focused on carbon dioxide transportation and storage aspects. While some learning can be drawn from work on industrial capture in Yorkshire and Teesside^{2,3} to date, there has been a lack of focus on its potential in Scotland. SCCS therefore proposed the workshops as a means of identifying the technical, economic, regulatory and policy-related barriers to, and drivers for, the creation of industrial CO₂ capture clusters in Scotland.

“In contrast to the power sector, several of the world's most carbon-intensive industries have no alternatives to CCS for deep emissions reduction because much of the CO₂ is unavoidably generated by their production processes, and not from fuel use. CCS will thus be essential for these sectors and this is where attention needs to be focused”

Global Action to Advance Carbon Capture and Storage:
A Focus on Industrial Applications, International
Energy Agency, 2013

This summary report describes results from these workshops, which are intended to help the Scottish Government, policy makers and other stakeholders develop a successful strategy for the deployment of carbon capture and storage (CCS) – with the aim of contributing to Scotland's ambitious emissions reduction targets⁴.

¹ Carbon Capture and Storage: CO₂ Transport Options for Scotland, Scottish Enterprise, 2011

² The national, regional and local economic benefits of the Yorkshire and Humber CCS cluster, CO₂Sense, 2012

³ Developing a CCS network in the Tees Valley Region: Final report for One North East and NEPIC, Element Energy, 2010

⁴ Climate Change Delivery Plan: Meeting Scotland's Statutory Climate Change Targets, Scottish Government, 2009



The potential for industrial emitter clusters in Scotland

The case can be made for reducing the cost of CO₂ emissions to businesses through the deployment of CCS. As with any fledgling technology, there will be significant costs associated with infrastructure development, but these can potentially be reduced where industry and power generation are co-located. As studies for Teesside have shown, this approach can provide an opportunity for strategic and effective infrastructure investment. An essential element for the deployment of industrial CCS in Scotland will therefore be the formation of clusters of large emitters, which include both power and industry sectors. The early engagement of these industries at the initial stages of the process will be crucial.

In order to provide useful background to workshop discussions, SCCS produced a briefing paper⁵, from which the following data has been extracted.

Power generation and industry in Scotland account for more than half of total CO₂ emissions. Industrial sub-sectors with emissions of more than 0.5 million tonnes a year include refineries and gas processing; chemicals; pulp, paper and board; inorganic materials (cement, glass); and environmental services (*Figure 1*).

Most onshore emissions derive from Scotland's Central Belt and around the Peterhead/St Fergus area in the north east. Two existing and potentially available high-pressure gas pipelines, named Feeder 8 and Feeder 10, pass through these areas. Around 73% of CO₂ emissions from power and industry combined come from within 10km of these pipelines, and 88% within 20km (*Figure 2*).

The workshop approach

Workshop 1: Policy, Economics, Regulations & Risk

The first workshop, held on 26 September 2013 at the National Museum of Edinburgh, explored the relevant policy and regulatory landscape in Scotland and the wider UK, and featured techno-economic case studies of industrial capture. These included valuable insights from the experience of the Teesside industrial CCS cluster, and progress being made by industries in China. Talks were followed by a panel-led participatory discussion of the economic, regulatory and policy barriers to, and drivers for, the development of CO₂ capture clusters in Scotland.

Workshop 2: Technology, Infrastructure & Opportunity

The second workshop, on 10 October 2013 at INEOS, Grangemouth, featured a comprehensive programme covering industry's views on the viability of CCS, taking a strategic approach to developing infrastructure, marketing opportunities, and the funding environment. There were also presentations from research groups and industry on improved efficiency and cost reduction for industrial capture. The day began with a review of Workshop 1 and ended with a participatory discussion.

The results of workshop discussions are highlighted in Key Outputs. Workshop agendas and presentations are available for download on our website: www.sccs.org.uk/industry-ccs.

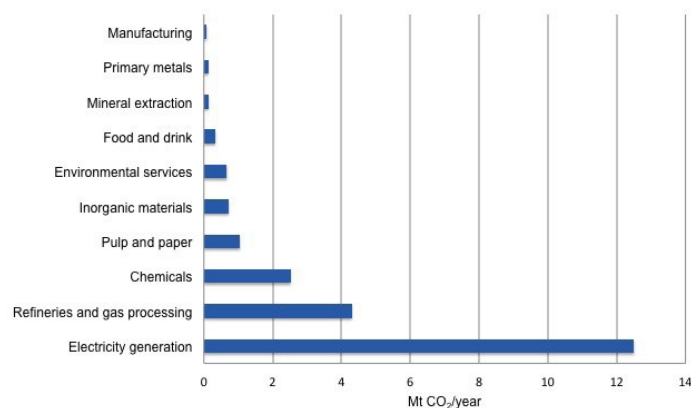


Figure 1. Scottish CO₂ emissions by industry sector in 2011
Source: SEPA, 2013⁶

“In addition, materials like steel, carbon fibres and concrete are fundamental to the supply chains of other low carbon technologies – e.g. wind and nuclear power – that seek sustainable lifecycle performance”

Global Action to Advance Carbon Capture and Storage:
A Focus on Industrial Applications, IEA, 2013



Figure 2. Groupings of industrial emitters in Scotland, showing combined annual emissions per cluster and proximity to existing pipelines, Feeder 8 and Feeder 10
Source: P Brownsort, SCCS

⁵ Industrial CO₂ Source Clusters in Scotland, P Brownsort, SCCS, 2013, www.sccs.org.uk/expertise/reports.html

⁶ Data from SEPA's Scottish Pollution Release Inventory, 2011, analysis by SCCS, 2013

Key Outputs

Both workshops featured detailed discussions of the issues and opportunities surrounding the deployment of CCS by industrial sectors. These underlined not only the challenges to be faced but also the potential that exists for industry in Scotland to pursue the technology, and the benefits it could bring.

Drivers: current & potential

Neutral

Barriers

How do we encourage industry to become engaged with CCS cluster development?

- ✓ Economic drivers for CCS are illustrated by international examples e.g. Howden's RAM development is entirely driven by forecasts of income from Enhanced Oil Recovery (EOR) in the USA
- ✓ Economic barriers can be lowered by reusing existing infrastructure and shared plant in clusters of industry and power generation emitters
- ✓ EU regulations and BREFs⁷ will start to necessitate industry involvement
- ✓ Put in place a long-term and robust regulatory framework
- ✓ Establishment of global sector agreements, e.g. for CCS in the refinery sector
- ✓ A long-term policy framework for CCS was considered beneficial by industry
- ✓ Taxation benefits for the Oil & Gas sector might enable infrastructure development
- ✓ A new communication plan is needed to define value, i.e. jobs, revenue, exports, inward investment, etc

- The Teesside industrial cluster has found that demand for low-carbon products and Life Cycle Assessment of products are encouraging industry to consider CCS, but the consensus was that, in Grangemouth, the key factors are feedstock and fuel costs
- There is a need to understand the complexity of the markets

- * Industry in Scotland is concentrating on maintaining business; the smaller emitters are waiting for the bigger emitters to lead on CCS; and the bigger emitters are waiting for the large power plants to show the way
- * If head offices are not based in Scotland then investment decisions are made outside the UK, and companies may relocate to where production costs are lowest. This poses a challenge to the deployment of CO₂ capture

How do we enable industry to become involved in developing CCS?

- ✓ Encourage the use of identified, readily available sources of high-purity CO₂ in the EU and the UK for EOR / early injection projects
- ✓ There is a need for industry and the Oil & Gas sector to discuss CO₂-EOR, before the window of opportunity in the North Sea closes
- ✓ Operators may support a strategy which provides them with an infrastructure, minimising their costs on a timescale they can work to
- ✓ Industry is a powerhouse of innovation, and novel developments may follow from their full engagement with CCS

- * The complexity of site infrastructure needs to be understood, including the need to clean up other emissions, such as NO_x and SO_x

What are the roles of policy makers, government bodies and regulators?

- ✓ The UK's Electricity Market Reform (EMR) needs to be resolved and Contracts for Difference (CfD) set at a level – and over a time period – that encourages investment
- ✓ Are there lessons to be learned from North America, e.g. regional programmes to demonstrate sequestration? However, CO₂-EOR has been a strong driver there, and the barriers to CO₂ transport and storage development are eased due to the low population density
- ✓ The Scottish Government and Scottish Enterprise have a role in developing and communicating the new value proposition

- SEPA must ensure that regulation is not a barrier to CCS

- * It was felt that policy makers are too inconsistent, and political timescales too short, for businesses to approach banks for investment; companies must consider the longer term, and most projects take at least two years to develop
- * The EU ETS reduces profits and does not encourage business to invest

⁷ Best Available Techniques reference document (BREFs), part of the EC's Industrial Emissions Directive (IED, 2010/75/EU)

Recommended actions for Scottish Enterprise to lead

- Develop a new communication plan for CCS, including industrial CCS, emphasising the value proposition to businesses
- Engage with industry decision makers
- Engage with industry innovators
- Identify sources of high-purity CO₂ from industry for EOR and early injection projects
- Bring Oil & Gas sector and industrial emitters around the table to avoid missing opportunities for EOR in Scotland



Speakers and delegates at the first Industrial Emitters workshop

Authors:

Dr Philippa Parmiter
Dr Peter Brownsort

Acknowledgements:

Many thanks to Scottish Enterprise for funding and participating in the Workshops for Industrial Emitters, and to Chemical Sciences Scotland and IChemE for publicising the events.

Workshops hosted by

Scottish Carbon Capture & Storage (SCCS), a research partnership of British Geological Survey, Heriot-Watt University and the University of Edinburgh.
www.sccs.org.uk

The University of Edinburgh's Carbon Capture Group, world renowned for its work in CO₂ capture and transport, and power plant engineering.
www.eng.ed.ac.uk/carboncapture

Supported by

